Supplementary Information

A sandwich-type photoelectrochemical biosensor based on $Ru(bpy)_3^{2+}$ sensitized In_2S_3 for aflatoxin B_1 detection

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Materials and Reagents

Indium nitrate hydrate, aelenium dioxide (SeO_2), thioacetamide (C_2H_5NS), 3-mercaptopropionic acid (MPA), tris(2,2′-bipyridine)dichlororuthenium(II) hexahydrate ($Ru(bpy)_3Cl_2·6H_2O$), sodium sulfide nonahydrate ($Na_2S·9H_2O$), zearalenone (ZEN), aflatoxin B_1 (AFB_1), potassium chloride (KCl), potassium ferricyanide ($K_3Fe(CN)_6$) and L-ascorbic acid (AA) were purchased from Macklin Biochemical Co., Ltd. (Shanghai, China). Sodium dihydrogen phosphate dihydrate ($NaH_2PO_4·2H_2O$) was gained from Sinopharm Chemical Reagent Co., Ltd. (Shanghai, China). Sodium chloride (NaCl) was purchased from Damao Chemical Reagent Factory (Tianjin, China). Potassium ferrocyanide trihydrate ($K_4Fe(CN)_6·3H_2O$) was obtained from Tianjin Guangfu Fine Chemical Research Institute (Tianjin, China). Ochratoxin A (OTA) was obtained from Aladdin Chemistry Co., Ltd. (Shanghai, China). N-hydroxysuccinimide (NHS), 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC), bovine serum albumin (BSA), disodium phosphate (Na_2HPO_4), T-2 toxin (T-2) and AFB_1 antibody were purchased from Shanghai Sangon Biotech Ltd. Co. (Shanghai, China). Indium tin oxide (ITO) electrodes were provided by South China Science &

Technology. The AFB_1 aptamer was synthesized and purified by Shanghai Sangon Biotech Ltd. Co. (Shanghai, China) with the sequence as follows:

AFB_1 aptamer: 5'-NH_2-C_6-GTT GGG CAC GTG TTG TCT CTC TGT GTC TCG TGC CCT TCG CTA GGC CC-3'

Apparatus

PEC performance measurement and electrochemical impedance spectroscopy (EIS) were carried out on a CHI 660D electrochemical workstation (CH Instruments, China). The electrolyte used in EIS was a 0.01 M phosphate buffer saline (PBS, pH 7.4) containing 0.1 M of KCl and 2 mM of $K_3[Fe(CN)_6/K_4[Fe(CN)_6]$ (1:1), the frequency was ranged from 100 kHz to 0.01 Hz, and the peak-to-peak amplitude of the AC potential was 5 mV. A conventional three-electrode system consisting of a modified ITO working electrode, a Ag|AgCl (saturated KCl) reference electrode, and a platinum wire counter electrode was used. A full-band xenon lamp (Nanjing Yan'an Special Lighting Factory, China) was used as the light source. Scanning electron microscopy (SEM) was carried out using S-4800 microscope (Hitachi, Japan). Transmission electron microscopy (TEM) was carried out using JEM-2100 microscope (JEOL, Japan). X-ray photoelectron spectroscopy (XPS) was performed with an ES-CALAB 250 spectroscopy (Thermo Fisher Ltd, USA). Ultraviolet-visible (UV-vis) spectroscopy was conducted using a UV-3600 spectrometer (Shimadzu Co., Ltd., Japan).

PEC measurements

The photocurrent signal was measured in 0.1 M PBS (pH 7.4) containing 0.1 M AA at the applied potential of 0 V. Tris/EDTA buffer (containing 10 mM Tris-HCl and 1 mM EDTA, pH 7.8-8.2) was utilized to wash the electrode surface after each-step modification to remove any unbound materials. Then, the wet surface of the electrode was dried with nitrogen. The working area of ITO electrode was 0.45 cm^2. The light source was switched on once every 20 s, and the photocurrent was generated when the electrode surface was subjected to light energy.